

Safety Data Sheet

N-[4-(5-Nitro-2-furanyl)-2-thiazolyl]-formamide

Division of Safety
National Institutes
of Health



WARNING!

THIS COMPOUND IS ABSORBED FROM THE INTESTINAL TRACT. IT IS CARCINOGENIC AND MUTAGENIC. AVOID FORMATION AND BREATHING OF AEROSOLS.

LABORATORY OPERATIONS SHOULD BE CONDUCTED IN A FUME HOOD, GLOVE BOX, OR VENTILATED CABINET.

AVOID SKIN CONTACT: IF EXPOSED, WASH WITH SOAP AND WATER.

FOR EYE EXPOSURE, IRRIGATE IMMEDIATELY WITH LARGE AMOUNTS OF WATER. FOR INGESTION, DRINK PLENTY OF MILK OR WATER. INDUCE VOMITING. FOR INHALATION, REMOVE VICTIM PROMPTLY TO CLEAN AIR. ADMINISTER RESCUE BREATHING IF NECESSARY. REFER TO PHYSICIAN.

IN CASE OF LABORATORY SPILL, WEAR PROTECTIVE CLOTHING DURING CLEANUP. AVOID SKIN CONTACT OR BREATHING OF AEROSOLS. USE ALCOHOL TO DISSOLVE COMPOUND. WASH DOWN AREA WITH SOAP AND WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY.

A. Background

N-[4-(5-Nitro-2-furanyl)-2-thiazolyl]-formamide (FANFT) is a yellow crystalline powder that is stable at room temperature in closed containers but slowly oxidizes on prolonged exposure to atmospheric oxygen. It has low acute toxicity in experimental animals but is a powerful urinary bladder carcinogen. FANFT is mutagenic to bacteria and to mammalian cells in tissue culture. Its only current use is in carcinogen research.

B. Chemical and Physical Data

1. Chemical Abstract No.: 24554-26-5

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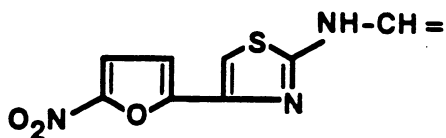
2. Synonyms:

FANFT

Formamide, N-[4-(5-nitro-2-furanyl)-
2-thiazolyl]- (9CI)

3. Molecular
formula:
 $C_8H_5N_3O_4S$
weight:
239.22

structure:



4. Density: No data.
5. Absorption spectroscopy: No quantitative data. FANFT absorbs in the UV region.
6. Volatility: No data; may be considered nonvolatile.
7. Solubility: Practically insoluble in water; soluble in ethanol, methanol, chloroform, dimethyl sulfide, and dimethyl sulfoxide.
8. Description and appearance: Yellow crystalline powder.
9. Boiling point: No data.
- Melting point: 295-300°C.
10. Stability: Stable in closed containers at room temperature. Prolonged exposure to air causes color change to reddish-brown, probably by oxidation.
11. Chemical reactivity: No data.
12. Flash point: No data.
13. Autoignition temperature: No data.
14. Explosive limits in air: No data.

Fire, Explosion, and Reactivity Hazard Data

1. FANFT does not require special fire-fighting procedures or equipment and does not present unusual fire and explosion hazards.
2. A condition contributing to instability is prolonged exposure to air.
3. No other incompatibilities are known to exist.
4. No hazardous decomposition products have been reported.

5. FANFT does not require nonspark equipment.

Operational Procedures

The NIH Guidelines for the Laboratory Use of Chemical Carcinogens describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving FANFT.

1. Chemical inactivation: No validated method reported.
2. Decontamination: Turn off equipment that could be affected by FANFT or the materials used for cleanup. If more than 1 g has been spilled or if there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Use alcohol to dissolve compound. Wash surfaces with copious quantities of water. Glassware should be rinsed (in a hood) with alcohol followed by soap and water. Animal cages should be washed with water.
3. Disposal: No waste streams containing FANFT shall be disposed of in sinks or general refuse. Surplus FANFT or chemical waste streams contaminated with FANFT shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal system. Nonchemical waste (e.g., animal carcasses and bedding) containing FANFT shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (e.g., tissue cultures) containing FANFT shall be disinfected by heat using a standard autoclave treatment and packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with FANFT shall be handled as potentially infectious waste and packaged for incineration, as above. Absorbent materials (e.g., associated with spill cleanup grossly contaminated) shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing FANFT shall be handled in accordance with the NIH radioactive waste disposal system.
4. Storage: Store solid FANFT or its solutions in bottles or vials sealed with a silicone septum having a Teflon liner. Avoid prolonged exposure to air.

Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. Sampling: No methods have been reported.
2. Separation and analysis: There are no analytical procedures for FANFT. Separation of urinary metabolites of FANFT by TLC and

identification under UV light have been described (Hayashida et al., 1976; Mukai et al., 1975).

Biological Effects (Animal and Human)

1. Absorption: FANFT is absorbed from the gastrointestinal tract after ingestion.
2. Distribution: No data.
3. Metabolism and excretion: FANFT is metabolized by deformylation ($-NH-CH=O \rightarrow -NH_2$) and this metabolite, which is toxic and mutagenic, is excreted in the urine (Hayashida et al., 1976). This compound has been postulated to be the proximal bladder carcinogen. The ultimate mutagen (and carcinogen?) may be the product of reduction of the nitro group of FANFT or the above metabolite (McCalla and Voutsinos, 1974).
4. Toxic effects: No acute LD50 data for FANFT exist, but on the basis of feeding studies in rodents and dogs, the toxicity appears to be quite low.
5. Carcinogenic effects: FANFT is a powerful bladder carcinogen in several rodent species and dogs (Erturk et al., 1970a, 1970b). Other target organs are renal pelvis and mammary glands, and leukemogenic effects are found in mice with involvement of thymus, spleen, and lymph glands.
6. Mutagenic and teratogenic effects: FANFT is mutagenic in E. coli and some Salmonella strains, and its metabolites damage bacterial DNA. There is no information concerning its teratogenicity.

Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash skin with soap and water. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes.
2. Ingestion: Drink plenty of milk or water. Induce vomiting.
3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary.
4. Refer to physician.

References

Erturk, E., S.A. Attassi, and O. Yoshida. 1970a. Comparative urinary and gall bladder carcinogenicity of N-[4-(5-nitro-2-furyl)-2-thiazolyl] formamide and N-[4-(5-nitro-2-furyl)-2-thiazolyl] acetamide in the dog. J Natl Cancer Inst 45:535-540.

- Erturk, E., S.M. Cohen, and G.T. Bryan. 1970b. Urinary bladder carcinogenicity of N-[4-(5-nitro-2-furyl)-2-thiazolyl] formamide in female Swiss mice. *Cancer Res* 30:1309-1311.
- Hayashida, S., C.Y. Wang, and G.T. Bryan. 1976. A simple method for detection and analysis of carcinogenic nitrofurans compounds and their metabolites by combining chromatography and spot mutation tests. *Gann* 67:617-619.
- McCalla, D.R., and D. Voutsinos. 1974. On the mutagenicity of nitrofurans. *Mutat Res* 26:3-16.
- Mukai, F.H., I. Hawryluk, and T.T. Finkelstein. 1975. Mutagenic activity in the urine of mice fed FANFT. *Mutat Res* 31:330-331.